A COMPARISON OF TWO TYPES OF EVAPORATION PANS.[1]

By G. A. LOVELAND, Meteorologist.

[Weather Bureau Office, Lincoln, Nebr., Jan. 26, 1921.]

SYNOPSIS.

The Briggs pan has a relatively large amount of water in a tank set in the ground with the top of the tank near the surface of the ground. The Weather Bureau tank has much less water and is placed all above the ground. The Weather Bureau tank evaporates from 30 per cent to nearly 50 per cent more water than the Briggs pan. The difference seems to depend more on the air temperature than on any other weather element. The tables give these differences in detail.

In the spring of 1917, a standard Weather Bureau evaporation pan was installed at the Agricultural experiment farm, Lincoln, Nebr. As this pan differed somewhat from the pan previously used to measure evaporation at the farm and from others in the State it seemed best to test the two types of pans by a series of observations with the two pans as nearly as possible similarly exposed to the weather.

The standard Weather Bureau pan is round, 4 feet in diameter and 10 inches deep. It was placed about 4 inches above the ground on wooden supports with air touching the sides and bottom. The water was kept about 4 inches below the top of the pan.

The other, or Briggs type of pan, is 7½ feet in diameter and 2 feet deep. It was set in the ordinary loess soil of the region, surrounded by grass. The top of the pan was flush with the ground. The water was kept as near as possible 4 inches below the top of the pan.

The tables give the monthly values of evaporation for the past four summers with some other related data, together with the differences in the monthly amounts and the percentage this difference is of the amount of evaporation in the Briggs pan.

The temperature and rainfall records were kept from standard instruments properly exposed near the pans. The anemometer, from which the wind velocity records were taken, was placed near the rim of the Weather Bureau pan, with the cups 5 inches above the top, which made them 19 inches above the Briggs pan. The relative humidity was taken from the records of the Lincoln station located about 3 miles distant.

It is realized that a 4-year record is too short to determine the laws controlling the differences in the readings, but some facts can be brought out that are interesting and valuable. The Weather Bureau pan consistently evaporated the most water with a large percentage of increase which varied considerably in different months. With three years' record in May and September and four years in the other months on the average for the season the Weather Bureau pan evaporated 43 per cent more than the Briggs pan—that is, the amount of evaporation measured in the Briggs pan multiplied by 1.43 would yield very approximately the amount that would be recorded in a Weather Bureau pan. On the other hand, the amount measured in a Weather Bureau pan multiplied by 0.70 would give the measurements of the Briggs pan.[2]

This short record seems to demonstrate the necessity of care in using the measurements from the two pans and the advisability of adopting as rapidly as possible the standard pan for all measurements of evaporation.

The reason for the larger evaporation of the Weather Bureau pan is due to the effect of the various and varying meteorological elements on the two types of pans. The smaller pan with the surface of the water somewhat higher and so more exposed to air movement and changes in temperature would result in a greater evaporation.

TABLE 1.—*Comparison of evaporation from Briggs and Weather Bureau pans.*

Month.	Year.	Evaporation.				Temperature.			Wind (miles per hour).	Humidity.	Precipitation.
		Briggs pan.	Weather Bureau pan.	Difference.	Difference.[1]	Mean maximum.	Mean minimum.	Mean.			
		Inches.	*Inches.*	*Inches.*	*P. ct.*	° *F.*	° *F.*	° *F.*		*P. ct.*	*Inches.*
May	1917	5.155	5.706	0.551	0.107	69	45	57	5.1	64	4.11
	1918	7.108	9.155	2.047	.288	80	54	67	6.9	60	3.04
	1919	.....	6.049	.....	.....	70	49	59	3.2	68	1.55
	1920	3.281	5.508	2.227	.679	71	50	61	3.9	72	5.11
	Sums	15.544	26.418	4.825	.....	.....	.....	.....	.....	.....	.....
	Average	5.181	6.603	1.608	.358	.....	.....	.....	4.8	66	.....
June	1917	6.915	9.273	2.358	0.341	80	58	69	4.2	63	6.39
	1918	7.452	10.561	3.109	.417	90	63	76	3.8	59	2.29
	1919	4.912	7.045	2.133	.434	81	62	71	2.8	75	6.78
	1920	6.264	8.277	2.013	.321	83	62	72	3.5	62	2.05
	Sums	25.543	35.156	9.613	.....	.....	.....	.....	.....	.....	.....
	Average	6.386	8.789	2.403	.378	.....	.....	.....	3.6	65	.....
July	1917	7.455	10.523	3.068	0.412	91	64	77	3.2	59	0.77
	1918	6.861	10.138	3.277	.478	90	65	77	3.8	59	2.18
	1919	7.995	11.700	3.705	.463	94	68	81	3.0	59	0.20
	1920	6.063	8.641	2.578	.425	88	63	76	2.1	62	3.77
	Sums	28.374	41.002	12.628	.....	.....	.....	.....	.....	.....	.....
	Average	7.094	10.250	3.157	.444	.....	.....	.....	3.0	60	.....
Aug.	1917	5.351	7.528	2.177	0.407	85	58	71	2.6	70	3.52
	1918	7.567	11.548	3.981	.526	95	67	81	4.2	57	0.72
	1919	6.083	9.101	3.018	.496	86	62	74	2.8	66	3.50
	1920	4.683	6.189	1.506	.322	83	59	71	1.1	67	4.83
	Sums	23.684	34.366	10.682	.....	.....	.....	.....	.....	.....	.....
	Average	5.921	8.592	2.670	.438	.....	.....	.....	2.7	65	.....
Sept.	1917	.....	5.408	.....	.....	79	54	66	3.2	72	2.22
	1918	4.761	7.467	2.706	0.568	73	47	60	4.4	59	1.71
	1919	4.791	7.150	2.359	.492	82	59	70	3.7	67	5.33
	1920	4.283	6.425	2.142	.500	82	55	68	2.7	68	1.18
	Sums	13.835	26.450	7.207	.....	.....	.....	.....	.....	.....	.....
	Average	4.612	6.612	2.402	.520	.....	.....	.....	3.5	66	.....
Oct.	1917	4.296	5.574	1.278	0.297	67	37	52	4.3	57	0.42
	1918	2.877	4.765	1.888	.656	68	47	57	4.9	70	4.96
	1919	2.105	2.616	0.511	.243	60	40	50	3.6	77	1.58
	1920	3.364	5.395	2.031	.603	72	46	59	3.6	65	3.08
	Sums	12.642	18.350	5.708	.....	.....	.....	.....	.....	.....	.....
	Average	3.160	4.588	1.427	.450	.....	.....	.....	4.1	67	.....

[1] The percentage this difference is of the amount of the evaporation in the Briggs pan.

[1] Presented before American Meteorological Society at Chicago, Dec. 29, 1920.

[2] This ratio of Weather Bureau pan to Briggs pan agrees very closely with theory, as is shown by a calculation based upon the results of Jefferies, that the rate of total evaporation from surfaces of the same shape and same orientation to the wind are to each other as the three-quarter powers of their respective areas. Such a calculation shows that the ratio of Weather Bureau pan to Briggs pan should be 0.67. Thus allowing for the effect of the difference of exposure, which, as the author shows, should cause the Weather Bureau pan to evaporate at a slightly greater rate than the Briggs, it appears that the agreement of these observations with theory is very good.—*W. J. H.*